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VARIABILITY OF THE DEPTH OF THE MINIMA OF THE DOUBLE SYSTEM HD 135421

BV Dra and BW Dra (ADS 9537, HD 135421) have been detected as eclipsing binaries by Batten and Hardie (1965).

Photometric observations by Wood (1970) Rucinski (1976) and Yamasaki (1979) have shown that they are normal W UMa systems. New photometric observations have been presented by Rovithis and Rovithis (1987) for the system. Dapergolas et al. (1989a, b) have also carried out BV photoelectric observations of BV Dra and BW Dra respectively.

These two eclipsing binaries were also observed from 16 May through 23 May 1990 with the 1.2m Kryonerion telescope and a single channel photon counting photometer. The photometer employs a high gain 9789QB phototube and conventional BV filters. Its output is fed directly to a microcomputer enabling rapid data access.

The data reduction is the standard one. The comparison star is for both cases BD +62° 1385 and the accuracy of observations is ± 0.02 mag.

Table I lists the dates of observations and phases covered whereas Figures 1 and 2 summarize the results for B and V colours.

TABLE I

a)	<u>BV Dra</u>	
	Date	Phase
	16 May 1990	.27 - .09
	18 May 1990	.0 - .76
	22 May 1990	.58 - .78
	23 May 1990	.27 - .02
b)	<u>BW Dra</u>	
	Date	Phase
	16 May 1990	.42 - .38
	18 May 1990	.27 - .20
	22 May 1990	.15 - .40
	23 May 1990	.38 - .23

In Table II the times of minima and the O-C values are listed for the V and B bands respectively.

Times of minima are calculated using the method described by Kwee and van Woerden (1956) whereas the O-C values were determined from the following linear ephemeris.
BV Dra $T = 2442878.372 + 0.3500663E$ (Geyer et al. (1982)).
BW Dra $T = 2442572.538 + 0.2921671E$ (Geyer et al. (1982)).

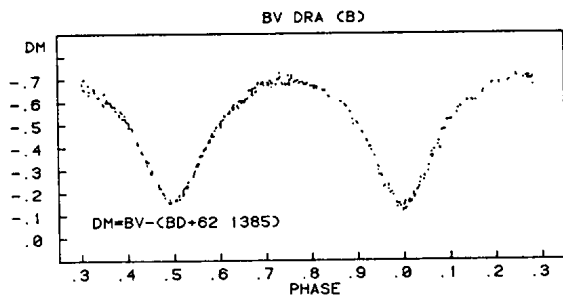


Figure 1a

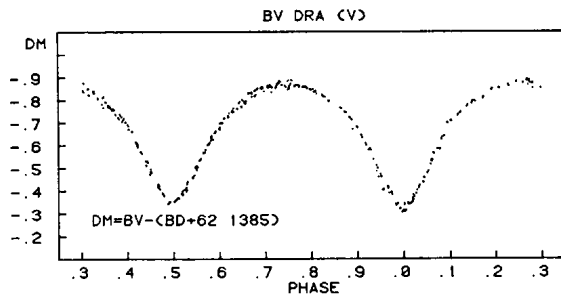


Figure 1b

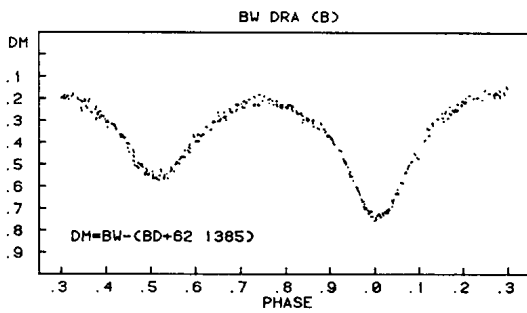


Figure 2a

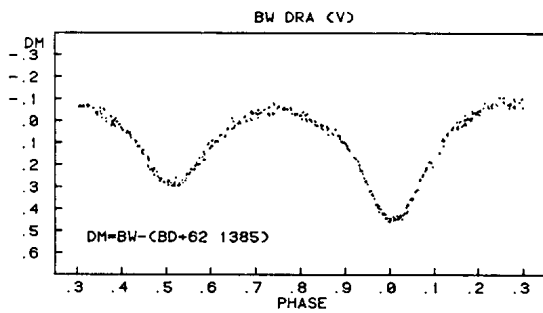


Figure 2b

Fig 1a, b shows the light curve of BV Dra for B, V colours respectively whereas Fig 2a, b are the same for BW Dra.

TABLE II

a) BV Dra

Type of minima	V colour		B colour	
	Heliocentric Jul. Day	(O-C) Phase	Heliocentric Jul. Day	(O-C) Phase
Secondary	2448028.3745	0.4982	2448028.3743	0.4977
	<i>q.0001</i>	<i>q.0003</i>	<i>q.0001</i>	<i>q.0003</i>
Primary	2448028.5489	0.9966	2448028.5491	0.9971
	<i>q.0003</i>	<i>q.0008</i>	<i>q.0002</i>	<i>q.0006</i>
Secondary	2448030.4756	0.5002	2448030.4752	0.4992
	<i>q.0002</i>	<i>q.0007</i>	<i>q.0002</i>	<i>q.0006</i>
Secondary	2448035.3758	0.4983	2448035.3759	0.4985
	<i>q.0002</i>	<i>q.0007</i>	<i>q.0002</i>	<i>q.0005</i>

a) BW Dra

Type of minima	V colour		B colour	
	Heliocentric Jul. Day	(O-C) Phase	Heliocentric Jul. Day	(O-C) Phase
Secondary	2448028.3251	0.516	2448028.3249	0.516
	<i>q.0003</i>	<i>q.001</i>	<i>q.0003</i>	<i>q.001</i>
Primary	2448028.4688	0.0083	2448028.4685	0.0072
	<i>q.0001</i>	<i>q.0003</i>	<i>q.0002</i>	<i>q.0006</i>
Secondary	2448030.37	0.5152	2448030.3705	0.517
	<i>q.0002</i>	<i>q.0007</i>	<i>q.0005</i>	<i>q.001</i>
Primary	2448030.5138	0.0075	2448030.5137	0.007
	<i>q.0002</i>	<i>q.0006</i>	<i>q.0003</i>	<i>q.001</i>
Secondary	2448035.3384	0.52	2448035.339	0.523
	<i>q.0005</i>	<i>q.002</i>	<i>q.0005</i>	<i>q.002</i>
Primary	2448035.481	0.0086	2448030.4812	0.0095
	<i>q.0003</i>	<i>q.0009</i>	<i>q.0003</i>	<i>q.0009</i>

From the Fig. 1a, b and Fig. 2a, b presented here it can be seen that BV Dra and BW Dra have symmetric light curves.

The differences between primary and secondary minima are ~ 0.18 mag in B and ~ 0.17 mag in V for BW Dra. From the observations presented previously by Dapergolas et al. (1989b), Rovithis and Rovithis (1987) and Geyer et al. (1982) it is found that the difference between primary and secondary minima is variable (see Table III) from year to year and doesn't change from colour to colour.

TABLE III

Differences between Primary and Secondary minima for BW Dra in B, V colours.

Date	B(mag)	V(mag)
1990	0.18	0.17
1989	0.11	0.1
1982	0.13	0.12
1981	0.07	0.07
1980	0.06	0.05

These differences between primary and secondary minima do not seem to exist for BV Dra.

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References

- Batten, A.H. and Hardie, R.H.: 1965, *Astron. J.* 70, 666.
Dapergolas, A., Kontizas, E. and Kontizas, M.: 1989a, *IBVS* no 3377.
Dapergolas, A., Kontizas, E. and Kontizas, M.: 1989b, *IBVS* no 3382.
Geyer, E.H., Hoffmann, M. and Karimie, M.T.: 1982, *Astron. Astrophys. Suppl. Ser.*, 48, 85.
Kwee, K.K. and van Woerden, H.: 1956, *Bull. Astr. Inst. Netherlands* 12, 327
Rovithis, P. and Rovithis - Livaniou, H.: 1987, *Astron. Astrophys. Suppl. Ser.* 70, 63.
Rucinski, S.M.: 1976, *IAU Symp.* 73, 349.
Wood, D.B.: 1970, *Bull. American Astron. Soc.*, 2, 357.
Yamasaki, A.: 1979, *Astrophys. Space Sci.*, 60, 173.